SILO CONSTRUCTION

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The necessary points to be considered in a good silo are that the walls should be impervious, strong, smooth and wind resistant. Several other points, not absolutely necessary but at least desirable, are durability, convenience, appearance, resistance to fire and frost, simplicity of construction, low cost (both initial and upkeep).

Impervious.—Preservation of silage depends upon retaining moisture within the silage and excluding the air; walls must be non-porous to prevent moisture passing out or in.

Strong.—Walls must be strong enough to resist pressure of silage which acts outwards in all directions as silage settles.

Smooth.—Walls must be smooth and jointless to allow silage to settle freely and prevent formation of air pockets which cause spoiled silage.

Wind.—The silo must be strong enough to resist, when empty, any wind. This is most essential in districts where high winds are common.

Durability.—The material of which the silo is built must resist the action of the weather, wetting and drying, freezing and thawing and any action of the silage.

Fire.—The value of a silo is much enhanced if fireproof.

Frost.—The silo should, if possible, be located on a protected side of buildings.

Convenience.—The silo should be convenient for filling and removing silage from day to day. Doors should be easily placed and removed. Provide easy access to allow removal of silage with least amount of labour.

Appearance.—A permanent silo of neat appearance adds much to the value of a farm.

Construction.—The ready-to-erect silo (particularly of the Stave type) ensures ease of construction.

Low Cost.—The silo which provides storage for silage at the least cost per ton is the silo to build, other things being equal.

Upkeep.—A silo which requires adjustment for weather and climatic conditions is less valuable than one not needing attention, as such attention may be neglected and the silo wrecked by wind. All parts of the silo should be equally durable and lasting.

Location.—The silo should have the chute adjoining the Feed Room; it should also be at the south end of barn rather than the north, if possible, as the barn protects the silo from north winds and sun reduces freezing probabilities.

The location of the silo *inside* the barn is not to be recommended, as apart from the waste of space in placing a circle inside a square or rectangle, the silo does not ordinarily need the protection of the barn.

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Design of Silos in General

Several general principles may be enumerated:—

1. The larger diameter silo costs less per ton capacity than the smaller, both being the same height.

2. Of two silos of the same diameter, the higher gives a greater capacity per foot height than the lower.

The greater percentage of mouldy and poor silage is found nearer the top than lower down as the weight compresses the silage and tends to exclude the air.

In *cool* weather, from 1½ to 2 inches should be fed per day from the surface, and in *warm* weather, from 2 or 3 inches per day.

Foundation.—The foundation of the silo should be broad enough to prevent appreciable settling in the ground and deep enough to rest upon soil unaffected by frost.

For wood silos, the foundation should be at least 1 foot above ground, in order to keep the wood dry; for concrete silos, 6 inches is sufficient. A foundation 3 to 4 feet below ground will prevent frost action and also provide a great deal of additional storage for the same height of wall (above ground).

FOUNDATIONS OF STAVE AND SCANTLING SILO 14′ DIAM.

Footings	1·87	bbls. cement	0·77	cu. yds. sand	1·54	cu. yds.	Stone or gravel
Floor (if desired)	2·67	"	1·1	"	2·2	"	"
Walls (4′)	7·46	"	3·07	"	6·14	"	"

Mixed 1: 2½: 5.

CAPACITIES OF SILOS IN TONS

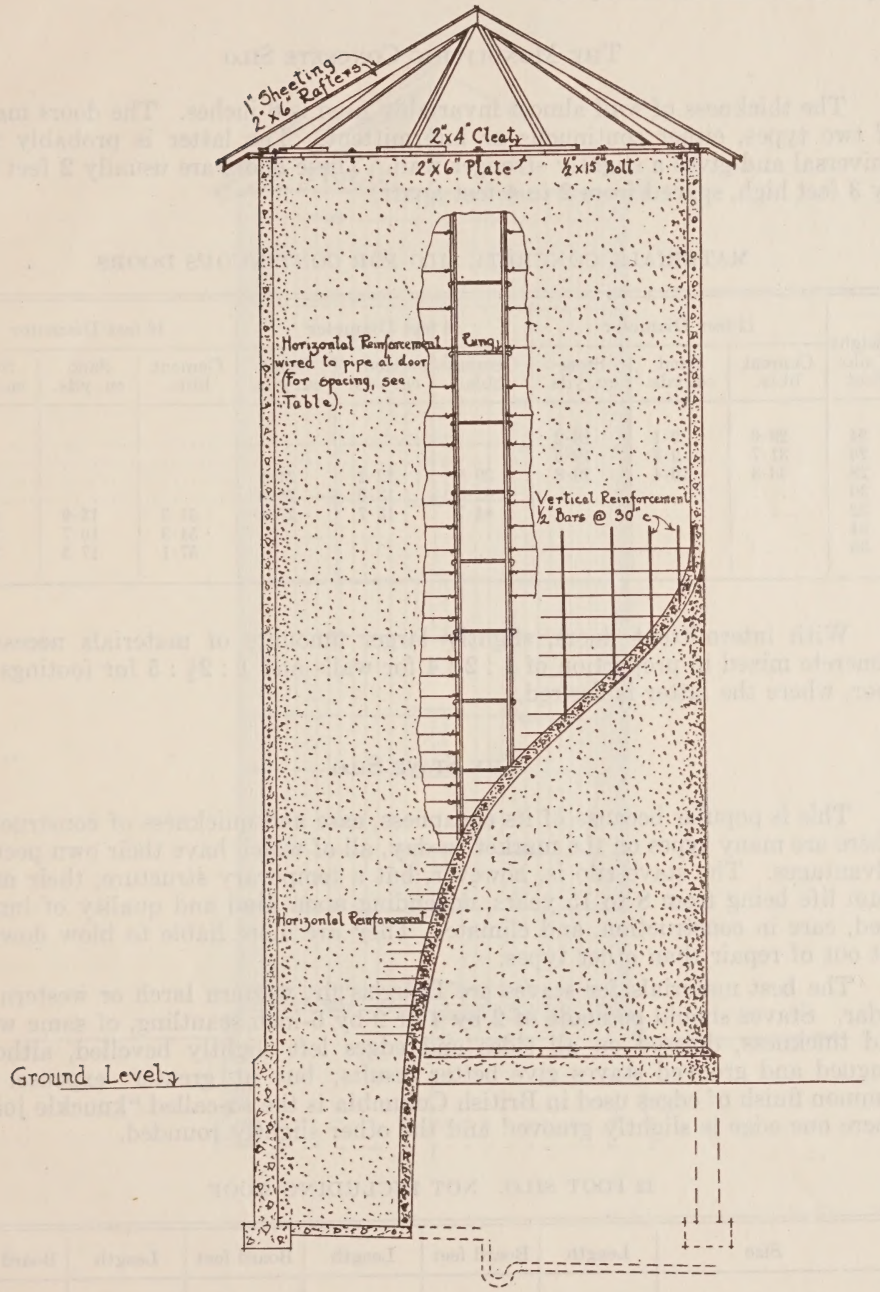
Diameter	Height						
	24	26	28	30	32	34	36
12	54–60	58–65	62–70	68–75			
14	70–75	75–80	85–90	90–100	95–105	100–110	
16	100–105	105–110	110–115	115–125	125–130	130–145	145–160

The Concrete Silo

This silo has the advantage of others in permanency and stability, but the initial cost is greater than for other types. Where materials are readily available and reasonably cheap the concrete silo is advisable as repairs are practically negligible and very little attention is necessary. The concrete silo has all the necessary features of a good silo and is, also, fireproof, vermin proof and even when empty, it resists the most severe winds. The only possible maintenance work necessary is the occasional (every three or four years) washing down of the inside walls with a wash of Portland cement and water mixed to the consistency of a thick cream.

Types.—The various types of concrete silos are the monolithic or one piece (either solid or hollow wall), the block, the concrete stave, and the stucco or plastered silo.

MONOLITHIC CONCRETE SILO



ELEVATION AND SECTION

Scale

0 1 2 3 4 5 6 7 8 9 10 Feet

Where forms can be easily obtained or made, the monolithic solid wall type is undoubtedly the best, particularly with sand and gravel at hand. Except for a good foreman, no skilled labour is required whereas the block or stave requires experienced masons for laying.

The Monolithic Concrete Silo

The thickness of wall almost invariably used is 6 inches. The doors may be of two types, either continuous or intermittent. The latter is probably more universal and gives a slightly stronger wall. These doors are usually 2 feet wide by 3 feet high, spaced from 2 to 4 feet apart.

MATERIALS, CONCRETE SILO FOR CONTINUOUS DOORS

Height of silo. Feet	12 feet Diameter			14 feet Diameter			16 feet Diameter		
	Cement bbls.	Sand cu. yds.	Stone cy. yds.	Cement bbls.	Sand cu. yds.	Stone cu. yds.	Cement bbls.	Sand cu. yds.	Stone cu. yds.
24	29·6	9·1	18·2	.....	.....	.....	.....	.....	.....
26	31·7	9·8	19·5	.....	.....	.....	.....	.....	.....
28	33·8	10·4	20·8	39·8	12·2	24·4	.....	.....	.....
30	.....	.....	.....	42·3	13·0	26·0	.....	.....	.....
32	.....	.....	.....	44·7	13·7	27·4	51·3	15·9	31·8
34	.....	.....	.....	.....	.....	.....	54·3	16·7	33·4
36	.....	.....	.....	.....	.....	.....	57·1	17·5	35·0

With intermittent doors, slightly larger amounts of materials necessary. Concrete mixed in proportion of 1 : 2 : 4 for walls and 1 : $2\frac{1}{2}$: 5 for footings and floor, where the latter is desired.

The Stave Silo

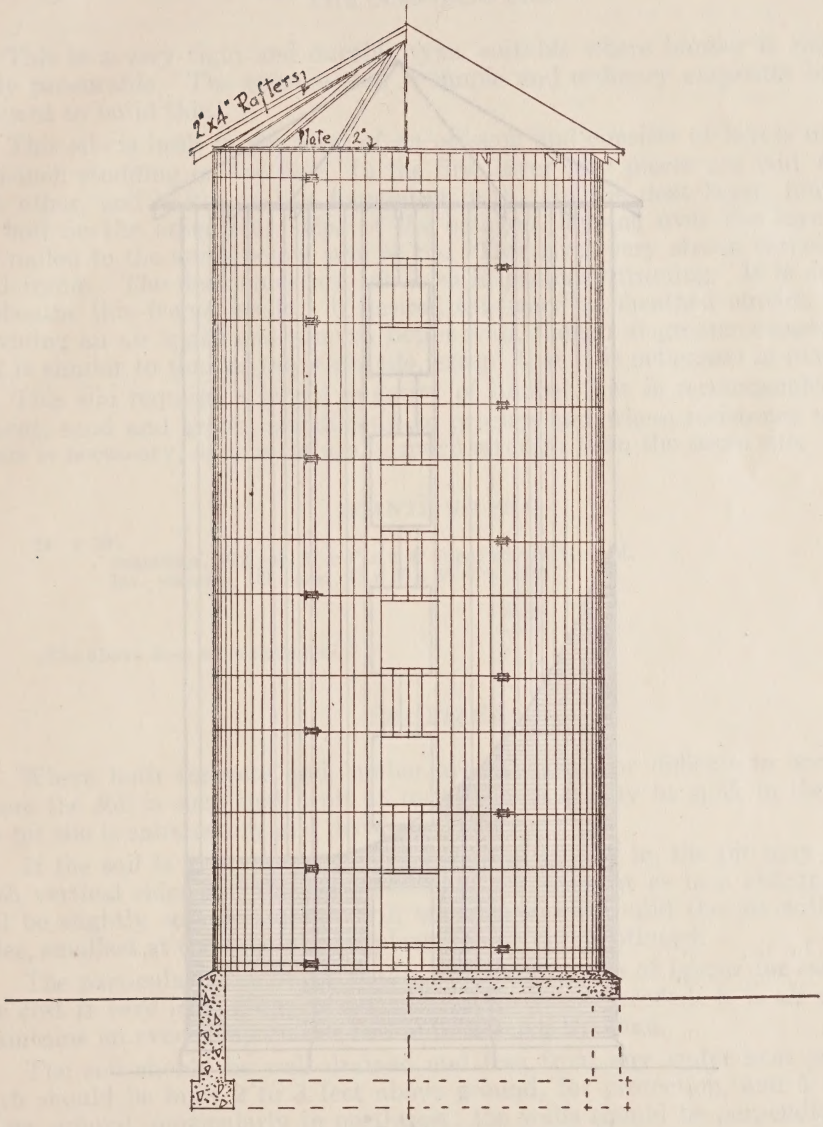
This is popular because of its cheapness, ease and quickness of construction. There are many types on the market to-day, all of which have their own peculiar advantages. The stave silo is, however, but a temporary structure, their maximum life being from 8 to 15 years, depending upon kind and quality of lumber used, care in construction, and climate. They are more liable to blow down or get out of repair than other types.

The best materials for staves are Douglas fir, western larch or western red cedar. Staves should be made of 2 by 4 or 2 by 6-inch scantling, of same width and thickness, dressed on all sides and edges left slightly bevelled, although tongued and grooved staves give better results, but at greater expense. A common finish of edges used in British Columbia is the so-called "knuckle joint," where one edge is slightly grooved and the other slightly rounded.

12 FOOT SILO. NOT INCLUDING ROOF

Size	Length	Board feet	Length	Board feet	Length	Board feet
12 75 pcs. 2 x 6.....	24	1,800	26	1,950	28	2,100
or 113 p.cs. 2 x 4.....	.....	1,800	.....	1,950	.....	2,100
14 88 pcs. 2 x 6.....	28	2,464	30	2,640	32	2,816
or 132 pcs. 2 x 4.....	.....	2,464	.....	2,640	.....	2,816
16 100 pcs. 2 x 6+1-2 x 3	32	3,200	34	3,400	36	3,600
or 161 pcs. 2 x 4.....	.....	3,200	.....	3,400	.....	3,600

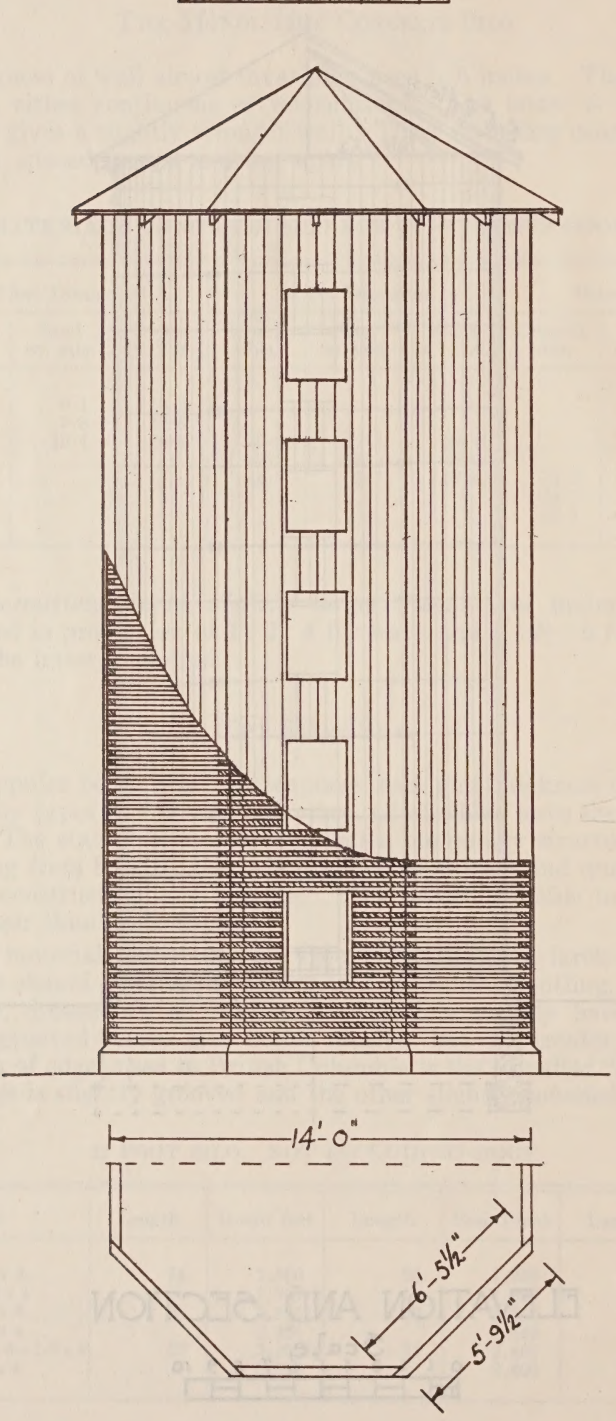
STAVE SILO



ELEVATION AND SECTION

Scale
0 1 2 3 4 5 6 7 8 9 10

SCANTLING SILO



Several types of ready-made silos might be mentioned:—

The Ideal, made by the DeLaval Co., Ltd., Montreal and Winnipeg.
The Beaver, made by the Beaver Lumber Co., Ltd., Winnipeg.

The Scantling Silo

This is a very rigid and durable type, suitable where lumber is cheap and easily procurable. The construction is simple and ordinary carpenter labour is sufficient to build this.

This silo is built in the form of an octagon and consists of layers of 2-inch by 4-inch studding on the flat. In the first layer four pieces are laid, opposite each other, and bolted to the foundation wall. In the next layer, four pieces are laid on the other four sides of the octagon, lapping over the layer below and nailed to the studs below, and so on. This gives very strong corners and a rigid frame. The door studs are set in as in ordinary framing. It is necessary to sheathe this frame inside. If desired this may be sheathed outside as well, providing an air space and a much better wall, though at greater expense. The roof is similar to that of the stave silo, except that it is octagonal in plan.

This silo requires a larger quantity of lumber, but is recommended where cement, sand and gravel are difficult to procure and where resistance to heavy winds is necessary, as it is naturally much stronger than the stave silo.

SCANTLING SILO

14′ x 28′.

Scantlings, 672 pcs. 2″ x 4″ x 6′-6″ (app)	= 2,912	ft. B.M.
Int. sheating, 88 pcs. 1″ x 6″ x 28′-0″	= 1,232	" "
	4,144	" "

(The above does not include roof.)

The Pit Silo

Where both concrete and lumber are expensive or difficult to secure, and where the soil is such that a pit 15 to 20 feet deep may be sunk in the ground, the pit silo is satisfactory and decidedly economical.

If the soil is firm enough to stand without caving in, the pit may be made with vertical sides and the sides plastered with cement as in a cistern. If the soil be slightly soft or loose, it will be necessary to build the pit with sloping sides, smallest at the bottom, and plaster as before mentioned.

The particular advantages of this silo are: Outside of labour for excavation, the cost is very low; filling is easy, as no hoisting is needed; it is air tight and maintains an even temperature and is unaffected by wind.

The soil should be well drained and free from any water near surface; a curb should be built 2 to 3 feet above ground, for protection, and 5 to 6 feet below ground, particularly in northwest; the walls should be perpendicular and smooth and consequently should be plastered with coat of cement and sand $\frac{3}{4}$-inch to 1-inch thick and then washed with wash of cement and water; a good tight cover should be provided.

The method of construction may be briefly summarized as follows:—

1. Level the ground and describe the two circles for the curb by means of a board swung from the centre, with two spikes 8 to 10 inches apart at end (depending on thickness of curb required). 2. Excavate trench for the curb and " true up " inside. 3. Fill trench with concrete as in house foundation; mixture, 1 part of cement to 7 or 8 of sand and gravel; concrete should be wet enough to run into place and then allowed to set, from 12 to 24 hours. 4. Excavate inside of curb and plaster. 5. Then excavate remainder to desired depth, about 5 feet deep at a time, " trueup " walls and plaster.

Plaster on the dirt walls should be three coats, mixed 1 part of cement to 3 of sand. When silo has been dug and plastering finished, wash walls with a mixture of cement and water as a cream and painted on with whitewash brush. Then build the curb 2 to 3 feet above the ground, of same mixture as below and build tight cover.

The Hoist (see model) is a good type and useful for removing soil in excavating as well as for later use in removing silage.

A " rounded " cement floor may be put in if desired.

Care should be exercised in entering a pit silo, the first few days after filling as carbonic acid gas is liable to generate over night, if the air be still, and particularly if the surface of the silage is much below the entrance to the silo. Ordinarily the air currents are sufficient to prevent this.

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